



# Advancement in the Area of Intrinsically Locatable Plastic Materials



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## Main Objective

This project was awarded to West Virginia University in order to develop, investigate, and compare alternative strategies for creating easily locatable advanced composite pipes using Carbon and Glass Fiber Reinforced Polymers – CFRP and GFRP - (with metallic or carbon nanoparticles in the resin for GFRP pipes). Investigation of pipe detectability will be done using above ground sensory technologies such as Ground Penetrating Radar (GPR) and Infrared Thermography (IRT).



Figure 1. GPR equipment setup.



Figure 2. IRT equipment.

## Project Approach/Scope

Major tasks to achieve the objective of the project are:

- ❖ Wrap plastic and GFRP pipes with aluminum or carbon fabric strips for easy detection
- ❖ Wrap plastic and GFRP pipes with aluminum or carbon fabric rings for easy detection
- ❖ Create CFRP and GFRP pipes with aluminum or carbon nanoparticles in the resin
- ❖ Investigate and compare the detectability of the above pipes (buried) using GPR and IRT



Figure 3. PVC pipe with CFRP rings and GFRP pipe with Aluminum rings.



Figure 4. Pipe samples being buried.

## Expected Results or Results to Date

### 1. Results To-Date:

- Preliminary GPR data revealed many of the 3" diameter pipes buried at 2' depth.
- Site was relatively wet, with soil dielectric constant of 19.75 and 21.65 at 2' and 4' depth respectively.
- 400 MHz radar antenna produced significantly better result compared to 900 MHz radar antenna for buried pipe detection.

### 2. Expected Results:

- Detection of deeper pipes (4' depth) when the soil is relatively dry.

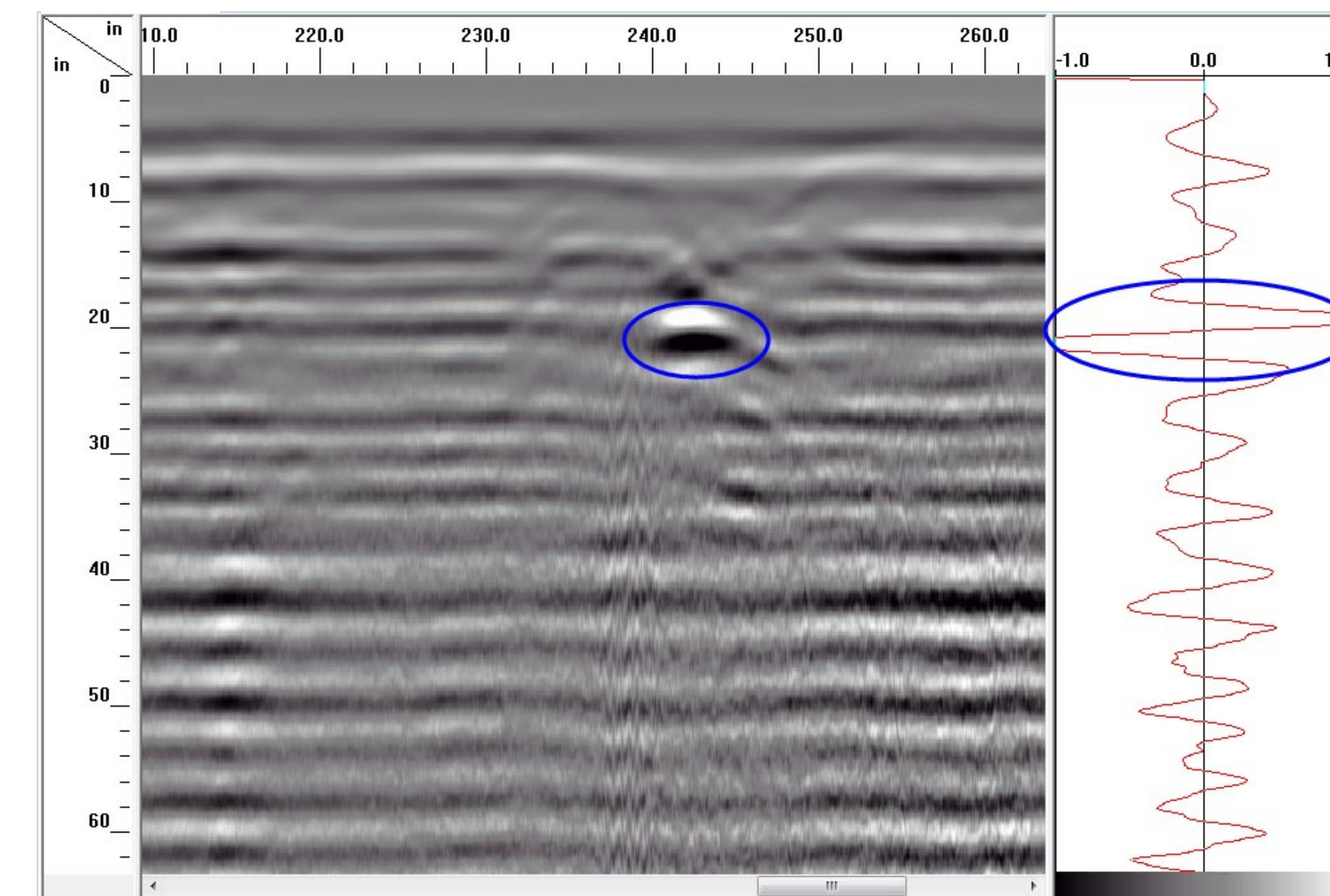


Figure 5. Sample cross-sectional GPR scan (left) and A-scan (right) over pipe wrapped with CFRP fabric.

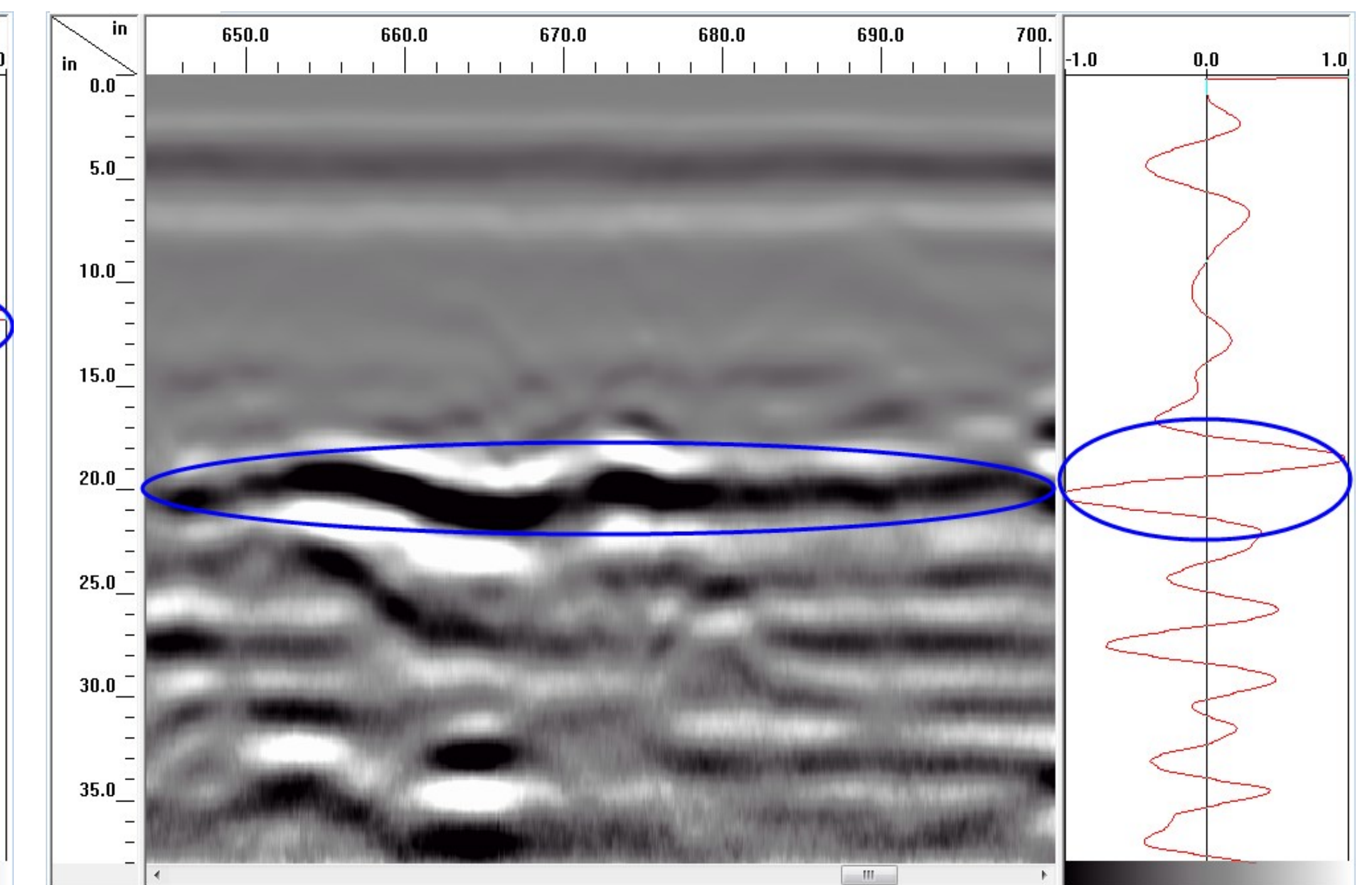


Figure 6. Sample longitudinal GPR scan (left) and A-scan (right) over pipes buried at 2' depth.

## Acknowledgments

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## References

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- Bowders, J. J. Jr., Koerner, R. M., Lord, A. E. Jr. (1982). "Buried Container Detection Using Ground-Probing Radar." *Journal of Hazardous Materials*. 7:1-17.

## Public Project Page

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